

## CLAIMS

What is claimed is:

1. A method of switching, comprising:
  - receiving an input data stream carrying plural tributary payloads
  - 5 from an external input link, each of the plural tributary payloads capable of being switched in space and time;
  - writing input columns of the input data stream to a common buffer according to a write pointer; and
  - in parallel with writing, reading from the common buffer to
  - 10 output columns of an output data stream according to a read pointer, the read pointer selecting, for each of the output columns, an input column from a limited portion of the buffer that contains a set of the input columns that are capable of being switched in time to the corresponding output column according to a communication protocol.
- 15 2. The method of claim 1 wherein the limited portion of the buffer depends on a corresponding location of the write pointer in the buffer, for each output column the corresponding location of the write pointer and the limited portion containing the set of input columns for reading being mutually exclusive.
3. The method of claim 1 wherein each of the plural tributary payloads is
- 20 characterized by an arbitrary type.
4. The method of claim 3 wherein each of the plural tributary payloads is characterized by a type selected from the group consisting of VT1.5, VT2, VT3 and VT4.

5. The method of claim 1 wherein each of the plural tributary payloads is characterized by a same type.
6. The method of claim 1 wherein the communication protocol is SONET.
7. The method of claim 1 wherein each of the plural tributary payloads comprise an  
5 ordered set of input columns that are interleaved within a payload of the input data stream, the method further comprising:  
in parallel with writing, reading from the common buffer to the output columns of the output data stream according to the read pointer, the read pointer selecting, for each of the output columns, an input  
10 column from a limited portion of the common buffer that contains a set of the input columns that are capable of being switched in time to the corresponding output column and maintaining the order of the input columns within each of the plural tributary payloads.
8. The method of claim 7 wherein the input data stream is a frame having columns  
15 and rows and the common buffer having a length substantially equal to a frame row.
9. The method of claim 8 further comprising:  
writing the input columns of the frame row into the common buffer sequentially from a beginning location to an end location of the  
20 buffer according to the write pointer; and  
in parallel with writing, reading the input columns from the common buffer to the output columns of the output data stream, the read pointer selecting, for each of the output columns, an input column from a limited portion of the common buffer that contains a set of the input

columns that are capable of being switched in time to the corresponding output column and maintaining the order of the input columns within each of the plural tributary payloads, the limited portion being a continuous range of buffer locations that depends on a corresponding location of the write pointer in the buffer.

10. The method of claim 8 wherein the frame is an STS-N frame and the buffer has a length substantially equal to 90N bytes.
11. The method of claim 7 wherein the input data stream is a frame having columns and rows and the common buffer having a length less than a frame row.
- 10 12. The method of claim 11 further comprising:
  - writing a first set of the input columns of the frame row into the common buffer sequentially from a beginning location to an end location of the buffer;
  - further writing a second set of the input columns of the frame row sequentially from an intermediate location to an end location of the buffer; and
  - in parallel with writing the first set and the second set of the input columns, reading the input columns from the common buffer to the output columns of the output data stream, the read pointer selecting, for each of the output columns, an input column from a limited portion of the common buffer that contains a set of the input columns that are capable of being switched in time to the corresponding output column and maintaining the order of the input columns within each of the plural tributary payloads, the limited portion including buffer locations that depend on a corresponding location of the write pointer in the buffer and

whether the first set or the second set of the input data units is being written.

13. The method of claim 11 wherein the frame is an STS-N frame and the buffer has a length substantially equal to  $62N$  bytes.

- 5 14. A switch comprising:

a plurality of inputs and a plurality of outputs;

each of the plurality of inputs receiving an input data stream carrying plural tributary payloads from an external input link, each of the plural tributary payloads capable of being switched in space and time;

- 10 a write controller causing input columns of the input data stream to be written to a common buffer according to a write pointer; and

a read controller, in parallel with the write controller, causing the input columns to be read from the common buffer to output columns of an output data stream according to a read pointer, the read pointer selecting, for each of the output columns, an input column from a limited portion of the buffer that contains a set of the input columns that are capable of being switched in time to the corresponding output column according to a communication protocol.

- 15 15. The switch of claim 14 wherein the limited portion of the buffer depends on a corresponding location of the write pointer in the buffer, for each output column the corresponding location of the write pointer and the limited portion containing the set of input columns for reading being mutually exclusive.

- 20 16. The switch of claim 14 wherein each of the plural tributary payloads is characterized by an arbitrary type.

17. The switch of claim 16 wherein each of the plural tributary payloads is characterized by a type selected from the group consisting of VT1.5, VT2, VT3 and VT4.
18. The switch of claim 14 wherein each of the plural tributary payloads is characterized by a same type.
19. The switch of claim 14 wherein the communication protocol is SONET.
20. The switch of claim 14 wherein:  
each of the plural tributary payloads comprise an ordered set of input columns that are interleaved within a payload of the input data stream; and  
the read controller, in parallel with write controller, causing the input columns from the common buffer to be read to the output columns of the output data stream according to the read pointer, the read pointer selecting, for each of the output columns, an input column from a limited portion of the common buffer that contains a set of the input columns that are capable of being switched in time to the corresponding output column and maintaining the order of the input columns within each of the plural tributary payloads.
21. The switch of claim 20 wherein the input data stream is a frame having columns and rows and the common buffer having a length substantially equal to a frame row.

22. The switch of claim 21 wherein:

the write controller causes the input columns of the frame row to be written into the common buffer sequentially from a beginning location to an end location of the buffer according to the write pointer;

5 the read controller, in parallel with the write controller, causes the input columns from the common buffer to be read to the output columns of the output data stream, the read pointer selecting, for each of the output columns, an input column from a limited portion of the common buffer that contains a set of the input columns that are capable of being  
10 switched in time to the corresponding output column and maintaining the order of the input columns within each of the plural tributary payloads; and

the limited portion is a continuous range of buffer locations that depends on a corresponding location of the write pointer in the buffer.

15 23. The switch of claim 21 wherein the frame is an STS-N frame and the buffer has a length substantially equal to 90N bytes.

24. The switch of claim 20 wherein the input data stream is a frame having columns and rows and the common buffer having a length less than a frame row.

25. The switch of claim 24 wherein:

20 the write controller causes a first set of the input columns of the frame row to be written into the common buffer sequentially from a beginning location to an end location of the buffer;

the write controller further causes a second set of the input columns of the frame row to be written sequentially from an intermediate  
25 location to an end location of the buffer;

the read controller, in parallel with the write controller, causes the input columns from the common buffer to be read to the output columns of the output data stream, the read pointer selecting, for each of the output columns, an input column from a limited portion of the common buffer that contains a set of the input columns that are capable of being switched in time to the corresponding output column and maintaining the order of the input columns within each of the plural tributary payloads; and

the limited portion includes buffer locations that depend on a corresponding location of the write pointer in the buffer and whether the first set or the second set of the input data units is being written.

26. The switch of claim 24 wherein the frame is an STS-N frame and the buffer has a length substantially equal to 62N bytes.

27. A switch comprising:

a plurality of inputs and a plurality of outputs;  
each of the plurality of inputs receiving an input data stream carrying plural tributary payloads from an external input link, each of the plural tributary payloads capable of being switched in space and time;  
a writing means for writing input columns of the input data stream to a common buffer according to a write pointer; and  
a read means for reading the input columns from common buffer to output columns of an output data stream according to a read pointer in parallel with the writing means, the read pointer selecting, for each of the output columns, an input column from a limited portion of the buffer that contains a set of the input columns that are capable of being switched in

time to the corresponding output column according to a communication protocol.